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ABSTRACT

A study was devised to investigate the effects of sequence of concept presentation and practice in a concept learning task. Learners were presented with either one conjunctive concept at a time, or with multiple concepts all related to the same principle. Practice was sequenced in four positions: before concept presentation, after concept presentation, both before and after, and all practice with no concept presentation. Material presented (develcped especially for the study) was a film study unit of an audiovisual materials and procedures course in education. Subjects were students in the class and were assigned to treatments in a randomized pretest-posttest control group design. Results of analyses showed that the various treatment groups were all significantly better on posttest, but did not differ significantly from one another. This result may be due to such things as timing of reinforcement, a ceiling effect produced by the efficacy of the instructional unit, or to failure of the principles behind the manipulations for the specific age group and task-type selected. (SH)

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THE EFFECT OF THE SEQUENCE OF INSTRUCTIONAL EVENTS IN A CONCEPT LEARNING TASK IN FILM STUDY

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INTRODUCTION

The problem of determining the most effective sequence for instructional events in an important consideration in the design of learning materials. The hierarchical sequencing of concepts from simplest to most complex, as described by Gagne (1965), has generally been accepted by learning product designers. The sequencing of specific instructional events within the teaching of a single concept however, has been the subject of some disagreement among educators.

Ausubel (1963) represents an expository or reception learning approach which maintains that a concept should be defined or presented for the learner prior to practice with concept exemplars. Bruner (1961) represents a discovery learning approach which maintains that a concept is better acquired and transferred if the learner generates the concept himself through examining concept exemplars before concept presentations.

Even in those studies that have attempted to operationally define discovery and reception learning approaches in terms of the sequence of instructional variables, it is difficult to attribute those results to sequence alone. Worthen (1965) in a longitudinal study reported that the discovery group outperformed the reception group only on the delayed posttest. While Worthen included numerous controls on teacher behavior and adjusted for inequalities in time and IQ, it is not clear whether the sequence of procedures alone could account for these differences. Teacher interaction with individual students was of central importance in the discovery strategy. The

feedback and resulting reinforcement of the individual learner may then have accounted for the superiority of this group on the delayed measure.

The introduction of programmed learning formats in studies into the discovery learning approach has provided some means for controlling the sequence of instructional stimulus and response events. Gagne and Brown (1961) adapted a mathematics program to study the effect of the degree of learner direction on performance. Yet, even in a controlled format, stimuli were not equated across treatments. The Guided-Discovery group appeared to be favoured: first, search behavior was rewarded; and secondly, more prompts were given than in the Rule-Example treatment.

Eldredge (1965) replicated the Gagne and Brown study after an extensive task analysis in which the stimulus materials were revised, and the number of prompt frames equated across treatments. The results of the first study were confirmed. The problem in generalizing the results of these two studies depends upon the operational definition of a "prompt": the nature of a prompt may well depend upon the nature of the concept or subject matter involved.

Wittrock (1963), avoiding the use of the term "prompts", manipulated in his study: (1) the order of rule and example; (2) rule given or not given; and (3) answer given or not given. Unfortunately, Wittrock allowed practice with only one example and no significant difference was reported in terms of the sequence of rule and example.

Much more opportunity for practice prior to presentation of

a principle was given to the discovery for Example-Rule treatment in a study by Werdelin (1968). This researcher found that on retention measures S's receiving the principle before practice with unsolved examples (Group A) outperformed only those S's receiving no principle at all (Group C). On measures of transfer, however, S's receiving practice first (Group B) outperformed S's in both Group A and Group C. His results were confirmed in a replication of the study on an alternate task. Both studies used basic cognitive principles (in mathematics and alphabet skills), and examined only two basic sequences of instructional events.

The present study further examined the effects of the sequence of concept presentation and practice by increasing the complexity of two instructional variables: the number of concepts presented and the position of concept practice in relation to concept presentation. Learners were presented with either one conjunctive concept at a time, or with multiple concepts (three or four), all related to the same principle. Practice was sequenced in four positions: (1) before concept presentation; (2) after concept presentation; (3) both before and after concept presentation; or, (4) all practice with no concept presentation.

The hypotheses of the study were:

(1) Learners who practice with exemplars of a concept both prior to and after the presentation of the concept will perform significantly better on measures of acquisition and transfer than learners who practice with exemplars of the concept either before or after the presentation of the concept;

(2) Learners who practice one concept at one time will perform significantly better than learners who practice multiple concepts at one time;

(3) Learners who are given both concept presentation and practice with exemplars will perform better than learners who receive only practice.

PROCEDURES

In order to systematically manipulate the two sequence variables (the order of concept presentation and practice, and the number of concepts presented or practiced) it was necessary to develop an instructional unit with discrete elements of stimulus events, administered in an instructional setting free of experimenter interaction. Concept presentation was defined as the definition of concept attributes, and the explanation of several exemplars for illustration of each concept. Practice was defined as learner response behavior consisting of viewing unfamiliar exemplars, and describing the appropriate concept illustrated.

Subjects

Subjects were education majors at Arizona State University who elected to take the film study unit as a course credit assignment for AV 411, Audio-Visual Materials and Procedures in Education.

Materials

The study unit on Identification of Symbols in Film was developed using two models: the Product Development Cycle (Gerlach,

1970) and Instructional Specifications (Sullivan, Baker and Schutz, 1971). The subject content of the unit consisted of the teaching of four conjunctive concepts related to the viewer's identification of film symbols. Each concept was defined by two attributes: two visual cues used by the film maker to indicate that certain images contained added or symbolic meaning.

Materials were paced by means of an instructional booklet containing both concept presentation and exercises for practice. Filmed exemplars (shot by the experimenter on Super 8 film and placed in loop cartridges) were displayed on a rear screen projection system at times appropriate to the treatment in order to elicit learner response practice. The information contained in the booklets and film exemplars was identical in all treatment groups: only the sequence, in respect to the number of concepts presented and the position of practice, was varied.

Criterion Measures

Three measures were used in the study: an identical pre- and posttest administered within the unit; and an alternate form of the test administered six weeks after the unit. Both measures consisted of a five minute segment from the Polanski film, Two Men and a Wardrobe, shown in conjunction with a two-part question requiring S: (1) to name at least four symbolic images in the given film segment and (2) to describe the film technique used by the film maker to cue each image to the viewer. After content validity was determined by consultation with four subject area specialists, the reliability of the measures was established at .85 by means of the alternate form test-retest method (Ebel, 1965).

Treatments

The study employed a randomized Pretest-Posttest-Control Group design (Campbell and Stanley, 1963). Six treatment groups and one control were set up representing specific levels of the two variables under study: (1) number of concepts presented; and (2) position of concept practice. Treatments are illustrated in Figure 1.

Insert Figure 1 about here

Groups A and B received presentation before practice, A received three concepts at a time, B received only one at a time. Groups C and D received practice, presentation, and additional practice; C with three concepts at a time, D with only one concept at a time. Group E received all practice before presentation of all concepts; and Group F received double practice time with no presentation of concepts. Control Group G received alternate program unit during an equivalent time period.

RESULTS

An analysis of variance was performed on pretest scores for the seven groups indicating no significant differences. An analysis of variance was then performed on posttest scores. The results of this test, summarized in Table 1, indicated a significant difference between groups at the .001 level.

Insert Table 1 about here

Figure 1

Experimental Treatment Variables

(2) position of practice	(1) Number of concepts presented: multiple	one	none
after presentation	A	B	
before and after presentations	C	D	
before presentation	E		
practice only			F

Table 1

Analysis of Variance

Immediate Post-test

Groups A, B, C, D, E, F, G

Source	SS	df	MS	F
Treatments	268.93	6	44.82	6.62**
Experimental Error	839.65	124	6.77	
Total	1,108.58			

**p. < .001

Comparisons between means on the posttest were computed by the Scheffe (1953) method and are summarized in Table 2. S's in Treatments A, B, C and D performed significantly better than those in Control Group G at the .01 level, while S's in E surpassed G'only at the .05 level. Thus, the three null hypotheses could not be rejected: (1) there was no significant differences between learners receiving one concept or multiple concepts at one time; (2) there

Insert Table 2 about here

were no significant differences among learners receiving practice before, after, or both before and after concept presentations; and (3) there were no significant differences between learners receiving concept presentation and practice and those receiving practice alone.

DISCUSSION

The lack of significant results may have been accounted for by two factors: the lack of sufficient practice for each concept within the constraints of the single 75 minute study session; and the lack of a powerful enough reinforcement contingency to ensure appropriate learner response. Several S's were observed waiting for knowledge of results supplied after the filmed exemplars, and continuation of the program was not made contingent upon appropriate en route learner response. Sullivan Baker & Schutz (1967, 1971) found that if a reinforcement contingency was made powerful enough, learner response was ensured and resulted in significant achievement differences in comparison with learners receiving less

Table 2

Scheffe Test for Comparison of Differences
between Immediate Post-test Treatment Means

Treatments	G	F	E	A	D	C	B
Means							
G 3.95		1.55	3.19*	3.70**	3.79**	4.12**	4.26**
F 5.50			1.64	2.15	2.24	2.57	2.71
E 7.14				.51	.60	.83	1.07
A 7.65					.09	.42	.56
D 7.74						.33	.47
C 8.07							.14
B 8.21							

**p. < .01
*p. < .05

powerful reinforcement. It was essential, therefore, that the reinforcement contingency be applied to both en route and criterion tasks in order to ensure continuous response.

Perhaps the most important conclusion to be made concerns the systematic development of the instructional study unit used in the experiment. The lack of significant differences between treatment groups given various sequences of instructional events might also be accounted for by the power of the Product Development Cycle (Gerlach, 1970), and the Instructional Specifications (Sullivan, et al., 1971) models used to produce the instructional unit. Considerable pre-planning is necessary in the use of these two models: the construction of a task analysis, instructional objectives, instructional cues, mastery items, stimulus limits, and criterion measures. This extensive definition of instructional events, as well as the developmental testing of all materials, may explain the success of different treatments in achieving the terminal objectives of the unit, regardless of the sequence of concept definition or practice.

Wittrock (1966) cautioned that results of many of the studies that have manipulated specified stimulus events in order to examine the degree of direction of learner behavior could not be generalized beyond the age levels of learners, or the subject content of the individual studies. The present study operationally defined instructional events in terms of the stimuli given the learner and the response behavior desired. Further studies, however, utilizing concept learning tasks with different levels of learners and subject content would be advisable in order to provide additional data to confirm or

extend the existing results. It may well be that in cognitive areas involving higher levels of learning such as analysis and evaluation, the sequence of events is not an important factor.

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